

## FLATTENING AND GUSSETING DEVICE, METHOD AND BAG

The present invention relates to an easy to open plastic film bag comprising a front bag wall and a rear bag wall joined to one another along bottom edges thereof and along opposed  
5 mutually substantially parallel lateral edges thereof by a first and a second inwardly directed lateral gusset extending along a respective one of said lateral edges to define a bag having a top opening defined by top edges of said front and rear walls.

Plastic film bags of this type are used as produce or grocery bags and the film, for instance  
10 of polyethylene, is normally quite thin. Such bags are difficult to open because of the tendency of the film of the front and rear walls to cling to one another because of several factors such as static electricity, cold welding, the cutting operations for forming the edges of the walls defining the bag opening and so on. As the exterior surfaces of the bag walls are smooth, it is difficult, particularly for persons having dry fingers, to apply enough  
15 frictional forces to the bag wall films to overcome said tendency to cling. Many persons moist their fingers with saliva to thereby achieve sufficient friction between the fingers and the bag wall surfaces. This is unhygienic because such persons often thereafter touch other objects subsequently bought by another person.

20 A bag of the type in reference is disclosed in GB 2 271 756 where an enhanced-friction zone is provided on the bag wall outer surfaces near the top opening by knurling, stippling or perforation of the film material of the zone. It is difficult to avoid that this roughening operation does not substantially increase the tendency of the bag walls to cling to one another.

25 US Patent No. 4,911,560 discloses a gusset bag of the type indicated where pleats are formed in the front and rear bag walls in the central region thereof between the gussets. By pulling the sides of the bag away from each other, the pleats slide open and thereby open the mouth of the bag. This bag is relatively difficult to manufacture and the pleats arranged  
30 along the central region give rise to an undesirable configuration of the bag bottom with resulting stress peaks at the bottom of the bag when fully loaded with produce or the like.

GB 2 289 038 discloses a non-gusseted bag of the T-shirt type having pleats in the front and rear walls in the region thereof between the handles. By pulling the handles away from  
35 each other, the pleats slide open and the bag mouth is opened. This bag suffers from the same disadvantages as the bag according to US 4,911,560 discussed above.

each other, the pleats slide open and the bag mouth is opened. This bag suffers from the same disadvantages as the bag according to US 4,911,560 discussed above.

5 It is a main object of the invention to provide an easy to open gusseted plastic film bag of the type indicated which is easy to manufacture, wherein the stress peaks at the bottom of the bag in loaded condition are minimized and where the desired configuration of the bag in loaded condition is as regular as possible.

10 According to the invention, this object is achieved by said front and rear walls being laterally displaced relative to one another such that the lateral edge of said front wall constituting the boundary between said front bag wall and said first and second lateral gusset, respectively, extends at a first and a second distance, respectively, from the corresponding lateral edge of said rear wall constituting the boundary between said rear bag wall and said first and second lateral gusset, respectively, thereby defining a first strip-like lateral zone with a width  
15 equal to said first distance and constituted by a portion of said first gusset and a portion of said front wall, and a second strip-like lateral zone with a width equal to said second distance and constituted by a portion of said second gusset and a portion of said rear wall.

20 By gripping the two opposed lateral zones and pulling the zones away from one another, the panels of each of the lateral gussets slide relative to one another thereby causing the front and rear bag walls to slide relative to one another and eliminate the tendency to cling to one another.

25 Hereby, the lateral gussets function as the pleats in the prior art bags discussed above but do not require further manufacturing steps and do not create deleterious geometrical conditions at the bottom of the bag with resulting stress peaks.

30 Although said first and second distances may be different as long as lateral zones wide enough to be gripped are created, in the currently preferred embodiment of a bag according to the invention said first and second distances are substantially the same size such that the widths of said first and second lateral zones are substantially the same.

35 Advantageously, the bag according to the invention may be a bag with two handles, for instance a T-shirt bag, the handles being integral with said walls and said gussets and extending upwards at the opposed ends of said top opening and inwards from said lateral edges, the width of each of said handles measured from the respective lateral edge being

larger than the respective one of said first and second distances such that said first and second lateral zones constitute a lateral portion of the respective handle. Hereby, both panels of each lateral gusset contribute to the strength of the handles.

- 5 In connection with bags according to the invention, with or without handles, said first and second distances should be as small as possible relative to the overall dimensions of the bag and with due consideration to the ease of gripping said lateral zones, because the smaller the distances are, the less the total width of the each of the lateral gussets is reduced which is of importance for the total volume of the bag in fully loaded condition.
- 10 Furthermore, in connection with a T-shirt bag according to the invention, the strength of the handles will be reduced less the smaller said distances are.

- Therefore, according to the invention, said first and/or second distance is preferably less than 50mm, more preferably less than 45mm, even more preferably less than 40mm, even
- 15 more preferably less than 35mm, even more preferably less than 30mm, even more preferably less than 25mm, even more preferably less than 20mm, even more preferably less than 18mm, even more preferably less than 16mm, and most preferably less than 14mm.

- 20 It is currently preferred that the first and second distances are between 10mm and 14mm.

- In the currently preferred embodiment of a bag according to the invention, indicia are applied, for instance by printing, to the outer surface of said front wall and/or said rear wall for indicating where and/or how said strip-like lateral zones are to be gripped and
- 25 manipulated, and said indicia may advantageously comprise printing applied within an area of at least one of said lateral zones and/or an arrow pointing towards a certain area of at least one of said lateral zones.

- In an alternative embodiment of a bag according to the invention, an aperture is provided
- 30 extending through at least one of said front and rear walls and each gusset, said aperture extending inwards from a point located between the innermost and the outermost of the pair of lateral edges of the front and rear walls corresponding to said gusset, preferably to a point located inwards of the innermost of said pair of lateral edges.

- 35 The aperture may thus be located entirely within one of said lateral strips or may interrupt the innermost of the lateral edges corresponding to the respective gusset.

Hereby, the opening of the bag may be carried out by inserting a finger in the aperture instead of gripping the respective lateral zone which may be easier for particularly elderly persons with reduced dexterity or eyesight. Thus the width of the respective lateral zone may be smaller because it does not have to be gripped. The apertures will furthermore  
 5 allow the bags to be dispensed and opened at the same time by inserting the diverging arms of prior art bag dispensing racks in said apertures.

In another aspect, the invention furthermore relates to a method of manufacturing easy to open plastic film bags, each comprising a front bag wall and a rear bag wall joined to one  
 10 another along bottom edges thereof and along opposed mutually substantially parallel lateral edges thereof by a first and a second inwardly directed lateral gusset extending along a respective one of said lateral edges to define a bag having a top opening defined by top edges of said front and rear walls, said front and rear walls being laterally displaced relative to one another such that the lateral edge of said front wall constituting the boundary  
 15 between said front bag wall and said first and second lateral gusset, respectively, extends at a first and a second distance, respectively, from the corresponding lateral edge of said rear wall constituting the boundary between said rear bag wall and said first and second lateral gusset, respectively, thereby defining a first strip-like lateral zone with a width equal to said first distance and constituted by a portion of said first gusset and a portion of said  
 20 front wall, and a second strip-like lateral zone with a width equal to said second distance and constituted by a portion of said second gusset and a portion of said rear wall, the method comprising the following steps:

- providing a continuous tube of a plastic film material,
- feeding said tube to a flattening and gusseting device in the direction of the tube axis,
- 25 - flattening said tube by pressing the sides thereof against each other in the direction of a first diameter of said tube substantially perpendicular to said axis,
- forming said first and second lateral gusset, preferably during said flattening step, by applying a first and a second pressing means, respectively, of said device to said tube for pressing generally opposed, but mutually offset, regions of the film material of said tube  
 30 inwards in a direction parallel to a second diameter of said tube substantially perpendicular to said first diameter, the first and second pressing means being displaced a first distance and a second distance, respectively, with respect to said second diameter in mutually opposed directions parallel to said first diameter such that the widths of the two inwardly directed, mutually joined panels of each lateral gusset formed thereby are different such  
 35 that said first and second lateral zones are formed.

Hereby, a very simple and easy to perform method of providing an easy to open bag according to the invention is provided where the manufacturing process is in no way more complicated than the prior art manufacturing process for producing gusseted bags of the type in reference.

5

In a further aspect, the present invention relates to an easy to open plastic film bag manufactured by means of a method according to the invention.

In a final aspect, the present invention relates to a flattening and gusseting device for manufacturing easy to open plastic film bags each comprising a front bag wall and a rear bag wall joined to one another along bottom edges thereof and along opposed mutually substantially parallel lateral edges thereof by a first and a second inwardly directed lateral gusset extending along a respective one of said lateral edges to define a bag having a top opening defined by top edges of said front and rear walls, said front and rear walls being laterally displaced relative to one another such that the lateral edge of said front wall constituting the boundary between said front bag wall and said first and second lateral gusset, respectively, extends at a first and a second distance, respectively, from the corresponding lateral edge of said rear wall constituting the boundary between said rear bag wall and said first and second lateral gusset, respectively, thereby defining a first strip-like lateral zone with a width equal to said first distance and constituted by a portion of said first gusset and a portion of said front wall, and a second strip-like lateral zone with a width equal to said second distance and constituted by a portion of said second gusset and a portion of said rear wall, said device comprising

- a driven roller for pulling a flattened extruded tube of plastic film material through said device,
- two converging arrays of flattening rollers arranged and adapted for flattening said tube when said tube is pulled between said arrays in the converging direction thereof,
- two generally opposed pressing means for pressing generally opposed regions of said tube inwards when said tube is pulled between said pressing means,

said pressing means being arranged displaceable both in a first radial direction towards the axis of said tube and a second direction transverse to, preferably at right angles to, said first direction such that said generally opposed regions may be mutually offset with respect to said axis to form said first and second lateral zones.

35

Hereby, a gusseting and flattening device is provided which only requires a relatively simple and cheap modification of a prior art device whereby the usual and well understood manufacturing process may be maintained in nearly all respects.

- 5 In the following, the invention will be explained more in detail with reference to various embodiments thereof shown, solely by way of example, in the accompanying drawings, where

Fig. 1 is a schematic plan view of a first embodiment of a plastic film bag according to the  
10 invention,

Fig. 2 is a schematic plan view of a second embodiment of a plastic film bag according to the invention,

- 15 Fig. 3 is a cross section in enlarged scale taken along line A-A in Fig. 1,

Fig. 4 is a schematic view of the embodiment of Fig. 1 illustrating the opening manipulation thereof,

- 20 Fig. 5 is a diagrammatic view illustrating a prior art method of manufacturing gusseted plastic film bags,

Fig. 6 is a diagrammatic view illustrating the method of manufacturing gusseted easy to open plastic film bags according to the invention,

- 25 Fig. 7 is a schematic broken away perspective view of a third embodiment of a plastic film bag according to the invention, and

Fig. 8 is a schematic, perspective, partly broken-away view of a flattening and gusseting device according to the invention.

30

- Referring now to Figs. 1 and 3, a bag 1 according to the invention made of a thin film of a plastic material such as polyethylene comprises a front wall 2 and a rear wall 3 joined to one another along the bottom edges thereof by means of a heat welding 4. The front wall 2 and the rear wall 3 are furthermore joined to one another along the lateral edges thereof by  
35 means of inwardly directed lateral gussets 5 and 6 comprising front panels 7 and 8, respectively, and rear panels 9 and 10, respectively.

The front panels 7 and 8 are joined to the rear panels 9 and 10, respectively along inner folds 11 and 12, respectively, and to the front wall 2 along boundary lines 13 and 14, respectively. The rear panels 9 and 10 are joined to the rear wall 3 along boundary lines 15 and 16, respectively.

5

The width of panel 9 is larger than the width of panel 7 such that a distance  $d_1$  is defined between boundary lines 13 and 15 in the flat condition of the bag 1 with the front wall 2 and the rear wall 3 abutting one another. Likewise, the width of panel 8 is larger than the width of panel 10 such that a distance  $d_2$  is defined between boundary lines 14 and 16 in said flat condition of the bag 1. Hereby, strip-like lateral zones 17 and 18 with widths  $d_1$  and  $d_2$ , respectively, are defined.

By gripping the lateral zones 17 and 18 as illustrated in Fig. 4 and pulling in the direction of the arrows R1 the front wall 2 and rear wall 3 will slide laterally relative to one another until the gussets 5 and 6 are eliminated because the panels 7 and 9 and 8 and 10, respectively, are straightened out such that the folds 11, 13, 12 and 16 disappear. In this condition, the bag 1 will be open at the top with no tendency of the front wall 2 and the rear wall 3 to cling to one another because of cold welding, static electricity and other factors present in the region adjacent an opening 19 defined at the top of the bag by unjoined top edges of the front and rear walls 2 and 3.

Handles 20 and 21 are defined by upwardly extending strips of the front and rear walls 2 and 3 as well as the gusset panels 7 and 9 and 8 and 10, respectively, welded together along welding seams 22 and 23, respectively. The width of the handles 20 and 21 is larger than the widths  $d_1$  and  $d_2$  of the lateral zones 17 and 18 such that the lateral zones 17 and 18 are constituted by a lateral portion of the handles 20 and 21, respectively. Hereby, each of the handles 20 and 21 will be constituted by four layers of film, namely the front and rear wall films and the gusset panel films.

The larger the distances  $d_1$  and  $d_2$ , which in the currently preferred embodiment of the bag according to the invention are substantially the same, the narrower the portion of the panels 7 and 10 contributing to the strength of the handles 20 and 21, respectively, will be.

Therefore, it will be advantageous for the strength of the handles 20 and 21 to maintain the widths  $d_1$  and  $d_2$  of the lateral zones 17 and 18 as small as possible with due consideration to the ease of gripping said zones for opening the bag mouth.

Referring now to Fig. 2, a bag 25 very similar to bag 1 of Fig. 1 is not provided with handles, the opening 26 at the top of the bag stretching across the entire top edge thereof. Indicia in the form of shaded or coloured areas 27, arrows 28 and written instructions are applied to the front and rear walls 2 and 3 as well as to the panels 8 and 9 to indicate where to grip  
 5 and how to open the bag by indicating the direction of pulling. The indicia may be of different kinds, for instance the entire top third of the lateral zones 17 and 18 may be shaded or coloured. These indicia may also be applied to the bag of Fig. 1.

Also in connection with this embodiment the widths d1 and d2 of the lateral zones 17 18  
 10 should be as small as practical because the total width of each of the lateral gussets 5 and 6 is reduced by d1 and d2, respectively, thereby reducing the total volume of the bag 25 in fully expanded condition. Furthermore, some of the advantages of lateral gussets reside in the shape of the bag at the bottom thereof, and the advantages inherent in lateral gussets in this respect are to a certain extent dependent on the width of the gussets.

15 It is currently preferred that the widths d1 and d2 are between 10mm and 14mm. However, smaller and larger widths d1 and d2 may be applied if the conditions of use, the plastic film material utilized, the overall size of the bag and other factors warrant it.

20 Referring now to Fig. 7, a bag 30 only differs from the bag 25 of Fig.2 by being provided with apertures 31 extending through the front and rear walls 2 and 3 as well as through the gussets 5 and 6 and interrupting the boundary folds 13 and 16. Hereby, a finger inserted in each of the apertures 31 and pulled in the direction of the arrows 32 will have the same effect as gripping the lateral zones 17 and 18 as explained above in connection with Fig. 4.

25 In this embodiment, the widths d1 and d2 of the lateral zones are solely determined by strength considerations and may be as small as such strength considerations dictate because the consideration of allowing gripping of the lateral zones is obviated by the apertures 31. Said apertures may have any size and shape and may be dimensioned for  
 30 insertion of fingers or of a pair of diverging arms of a bag dispensing rack known in the art. Apertures 31 may likewise be applied to the bag of Fig. 1.

The apertures 31 may also be located entirely within the lateral zones 17 and 18, i.e. with the folds 13 and 16 being uninterrupted.



Referring now to Fig. 5, a prior art method for manufacturing plastic film gusset bags is illustrated, the bottom part of Fig. 5 being an elevational view and the top part being a top view of the same elements as the bottom part.

- 5 This prior art method comprises extruding a tube 39 of plastic film from an extruder at 40 and moving the tube upwards in the direction of the tube axis 41 to a flattening and gusseting device (see Fig. 8) where the tube 39 is flattened at 42 in the direction of the axis 41 parallel to a first diameter 43 of the tube while at the same time being pressed inwardly in the direction of the axis 41 parallel to a second diameter 44 perpendicular to diameter 42  
10 by means of wedge shaped gusseting boards 45 and 46. Bottom welding, handle forming and any printing thereafter is performed at stations symbolized by station 47 whereafter the flattened tube is rolled up on a roller 48.

- Referring now to Fig. 6, the method according to the invention is identical to the prior art  
15 method of Fig. 5 except that the gusseting boards 45 and 46 have been laterally displaced (or mutually offset) distances  $d_3$  and  $d_4$ , respectively, with respect to the diameter 44 such that the gussets 5 and 6 formed by the gusseting boards 45 and 46, respectively, are asymmetrical with the panel 9 being  $d_1$  wider than panel 7 and panel 8 being  $d_2$  wider than panel 10 as explained above with relation to Fig. 1.

20

- Referring now to Fig. 8, a flattening and gusseting device according to the invention comprises a double converging array of flattening rollers 50 for flattening the extruded plastic film tube 38 as explained above, one of the flattening rollers being cut away in the Figure so as to show the pressing edge 54 of the gusseting board 46. The gusseting boards  
25 45 and 46 are arranged displaceable (mutually offsetable) in the directions  $R_4$ ,  $R_5$ , respectively, which is illustrated symbolically by the suspension of the gusseting boards on axles 51 having adjustment screws 52 for displacing the top and bottom of the boards to and fro in the direction of the axles 51 (in the direction of a radius of the circular cross section of the tube) for varying the inward extent of the gussets, i.e. the width of the panels  
30 thereof. The above features are incorporated in prior art devices.

- The novel features of the device according to the invention comprise a further displaceable arrangement of the gusseting boards 45 and 46 affording the possibility of displacing the gusseting boards in the directions  $R_2$  and  $R_3$  perpendicular to the axles 51 which is  
35 illustrated symbolically by means of the shown suspension plates 53 that may be displaced in the directions  $R_2$  and  $R_3$ , for instance the distances  $d_3$  and  $d_4$ , respectively, shown in

Fig. 6, whereby the total distance  $d_5$  between the pressing edges 54 and 55 of the boards 46 and 45, respectively, is achieved,  $d_5$  being equal to the sum of  $d_3$  and  $d_4$ . The lateral displacement directions  $R_2$  and  $R_3$  of the gusseting boards do not necessarily have to be perpendicular to the axles 51 as long as a displacement transverse to the axles 51 may  
5 result in the desired offsetting of the boards with respect to the axis 41 of the tube 39.

Naturally, the pressing means for forming gussets and the flattening means may be configured in many other ways which will be obvious to those skilled in the art.